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ABSTRACT

Monitoring the effectiveness of reading education is central to the appraisal of the productivity of schooling, yet most measures currently being used do not take into account the full range of processes which lead to successful reading education. A model of indicators relevant to reading education (outcome, process, and input) can be used to judge more accurately the health of the educational system. Outcome indicators, which describe the results of educational efforts, should include performance on the following sub-aspects of reading: (1) decoding, (2) literal comprehension, (3) locating information, and (4) higher order processes. Process indicators measure a means for achieving desired results, and contain the dual traits of instructional effectiveness--quality and quantity. Quantity of instruction includes the number of courses taken, the quantity of reading instruction, and the quantity of reading for homework. Quality of instruction entails not the time, but the events that occur in time that are instrumental for learning. Characteristics of quality instruction include using students' background knowledge, summarizing, and teaching vocabulary and inferencing. Input indicators describe resources for the educational process such as school plant and equipment, educational and ethnic characteristics of students, and literacy materials at home. Indicators such as these can be used for policy purposes, as well as for research on learning and teaching. (Thirty references are attached.) (MM)

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Indicators of Reading Education

John T. Guthrie

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SUMMARY

In order to communicate effectively, students must be able to read and to clearly understand what they read. As a consequence, monitoring the effectiveness of reading education is central to the appraisal of the productivity of schooling. Yet, most measures currently being used, do not take into account the full range of processes which lead to successful reading education. This paper proposes a model of indicators which could be used to more accurately judge the health of the educational system. It does not, however, explore the feasibility of implementing these indicators or alternative strategies for collecting data on the various measures.

Three types of indicators are relevant to reading education: outcome, process, and input. Input variables, which describe resources for the educational process such as school plant and equipment, educational and ethnic characteristics of students, and literacy materials in the home, are not discussed at length here although they do moderate the impact of educational processes on student outcomes in readings.

Outcome Indicators

Indicators of outcomes describe the results of educational efforts. Most often, standardized reading achievement tests are the sole form of outcome measure and the problems with this approach are numerous. But the primary shortcoming of standardized tests is that they do not reflect the complexity of the reading process.

An ideal model of indicators for reading education will contain outcome measures that suitably reflect developmental processes of reading acquisition, and curriculum goals of teachers and policymakers. A full set of outcome indicators should include performance on the following sub-aspects of reading: 1)decoding, 2) literal comprehension, 3) locating information, and 4) higher order processes.

It is essential that measures of reading achievement be balanced by indicators of the active use of reading. Indicators of reading activity have not previously been employed, although national data, and data for at least one state, exist on this variable. Whether students choose to read, affects not only grade point averages, but also their knowledge of the world, recreational satisfaction, and occupational productivity.

Process Indicators

The dual traits of instructional effectiveness--its quantity and quality--both should be contained in a full model of indicators. The

quantity of instruction has been verified as a causal factor in reading achievement. Student learning time is the critical factor and its estimation may be based on teacher self-report, student self-report, or observation.

Vital qualities of reading instruction have been identified in research. Recent advances in the cognitive and social psychology of reading development have yielded a set of principles that are conceptually coherent and empirically grounded, although building policy-relevant indicators from these findings requires ingenuity. The two variables of quantity and quality are amenable to development as indicators which can serve as key statistics for policymakers as they seek to improve the education of children.

Editor's Abstract

ACKNOWLEDGEMENTS

I would like to express appreciation to Mike Smith, who originally suggested this piece, and to Ramsay Selden, who commented constructively on the first draft. All errors and oversights are my own.

* * * * *

John T. Guthrie is director of the Center for Educational Research and Development and Professor in the College of Education at the University of Maryland. From 1974-1984, he was director of research for the International Reading Association. Dr. Guthrie currently is exploring the nature and extent of literacy activities among American youth, from descriptive, explanatory, and policy perspectives.

INTRODUCTION

> Key statistics are seldom available to help legislators, policymakers, and laymen understand in uncomplicated terms how education is changing.
>
> Krathwohl, 1975

The reform movement in elementary and secondary education has emphasized the need for enhancing the reading and writing skills of all students. Effective communication is needed to participate in school activities, to learn from textbooks, to acquire knowledge independently at the high school level, and increasingly, to perform adequately in occupational contexts. As a consequence, monitoring the effectiveness of reading education is central to the appraisal of the productivity of schooling.

Reading assessments are being deployed by administrators to shape the curriculum. As Commissioners of Education Turlington and Tirrozi have stated, tests can be used to set standards and goals, which will influence the content of curricula (Guthrie and Lissitz 1985). Because indicators are not merely passive statistics but are pro-active agents of change, they must be selected carefully.

The purpose of this paper is to explore indicators that may be used to appraise the quality of reading education in elementary and secondary schools. It does not address the feasibility of implementing the suggested indicators or alternative strategies for collecting data on the measures.

Before presenting a specific set of indicators and the rationale for them, however, it is necessary to describe what is meant by the term, "indicator." This term refers to a statistic that has several properties. First, an indicator may be a goal of reading education or a means to attaining it. Second, it is usually understood by a broad audience. Third, it is amendable to changes by policy. Fourth, it measures something that can be compared across educational systems or across time within a single system.

Three types of indicators are relevant to reading education. First, indicators of outcomes describe the results of educational

efforts or the products of the system of teachers, students, administrators and parents. Most often, reading achievement tests are the sole form of outcome measure. Their limitations, particularly the shortcomings of standardized tests, will be discussed. Second, indicators of educational process may be employed. These represent the characteristics of teachers, classroom interactions, learning materials, and school leadership. The third category of indicators is input variables that are resources for the educational processes. These may include school plant and equipment, the educational and ethnic characteristics of students and literacy materials in the home. Due to space limitations these factors will not be discussed at length as factors in the effectiveness of reading education, although they represent factors that moderate the impact of educational processes on student outcomes in reading.

The criteria for selecting indicators are diverse and varied across different catagories of indicators. Outcome indicators are based, in part, on value judgements. As a nation, we affirm the role of reading as a tool for school learning, self improvement and participation in society (Boyer 1983). Our concept of reading is evolving as the complexity of learning environments and societal demands for literacy increase. Measuring higher order processes in reading, which may include reasoning and problem solving, is receiving increased emphasis. However, the selection of outcome indicators is limited by the techniques of measurement in reading (Johnston 1984).

The selection of process indicators is based on both empirical and conceptual criteria. An indicator of educational process such as the quantity of instruction must consistently influence a reading outcome such as achievement, if it is to be valid for policy purposes. The indicators selected in this paper are drawn from both macro-studies and micro-studies of reading education. The former reveals process variables that influence achievement in large sets of data. They may span dozens of small studies or one corpus of data embracing a large number of studies. In these macro-studies a number of variables such as student ethnicity and the affluence of the school have been controlled. The indicators are relatively free of contamination from

correlated factors and are good candidates for causal variables rather than being artifacts or consequences of other determinant factors. In addition, some of the indicators are drawn from micro-studies of reading education. Most investigations of the quality of instruction, for example, are made with relatively few subjects in confined curricula. Due to their survival through replication and their correspondence to theories of the reading process, however, variables emerging from them warrant a place in a broader model of indicators.

II. OUTCOME INDICATORS

READING PROCESSES

The press and the public find bittersweet pleasure in saying that Johnny can't read. This contention, however, is a little like saying that Johnny can't cook. Whereas Johnny may not be able to satisfy the critics with Peking Duck, he may be adroit at boiling an egg. Even though the search for reading indicators takes place in a policy context which requires measures that are manageable, it is critical to avoid radical oversimplification. The hazard of being simplistic is that Johnny's reading will be misunderstood, teachers will be mislead, parents will be outraged, and policymakers will be frustrated in their attempts to improve reading achievement.

The reading level of children in a school or a state can be defined by three criteria. First, the criterion of the necessary minimum refers to the extent that all students perform at a level required to survive or cope in their environment. The proportion of students who pass a "functional literacy" or "minimum competency" measure illustrates this type of statistic. The second type of index is the average achievement of students on a reading test that may be norm referenced or criterion referenced. The third type, maximum performance, reflects the proportion of students who achieve highly compared to a conceived standard or to other populations. Illustrative statistics may be the proportion of students who attend college, or who are National Merit Finalists and winners of academic honors. Distinctions between levels of measurement are not trivial. International comparisons of reading comprehension among 14 year olds in 1973 showed the United States was ranked 2nd out of 15 countries based on mean scores whereas the US was ranked 8th on proportion of students who passed the test with an arbitrary minimum score.

When policymakers address the problem of the minimum, they confront populations that include low income and minority language users, and their solutions will include parent involvement and remediation, among other approaches. The problem of the mean, on the

other hand, will include all students in the population and may encompass broader school system interventions. Enhancing achievement of higher achievers will be pertinent for a population of adept, highly-prepared learners who require support systems of enrichment and challenge.

In addition to defining whether policy is directed to the minimum, the mean or the maximum on the reading continuum, the age and developmental level of students must be considered in selecting indicators. As reading is acquired from kindergarten through 12th grade, different cognitive components emerge at different points on the growth curve. Although reading may be broadly defined as gaining meaning from written language, the factors that influence how well a child succeeds are different at different stages in the course of schooling.

Standardized measures of reading outcomes usually are not accurate reflections of the reading process. Shortcomings of existing measures were summarized by the National Academy of Education Panel headed by Richard Anderson of the University of Illinois.

> Standardized tests of reading comprehension manifestly do not measure everything required to understand and appreciate a novel, learn from a textbook, or find items in a catalogue.
>
> Becoming a Nation of Readers, 1985

The primary shortcoming of standardized tests is that they do not reflect the complexity of the reading process. Although researchers dispute their weights, they concur that the following factors are associated with gains in reading comprehension: 1) linguistic awareness (knowledge of how spoken language works), 2) decoding (which refers to understanding symbol-sound correspondences of letters); 3) vocabulary (word meanings and their nuances); 4) text comprehension (verbatim understanding of sentences or short paragraphs); 5) information search (detecting specific detail in a passage or a table); 6) meta-cognitive processes (strategies for repairing misunderstandings during reading); and, 7) interpretation/criticism (understanding beyond the literal text and evaluation of an author's opinion or argument against an external standard).

Existing tests of reading achievement are limited as indicators of growth in reading because they emphasize the middle range of this developmental spectrum. Most standardized tests and criterion referenced measures emphasize vocabulary and literal comprehension. Even tests that purport to measure paragraph comprehension or inferential understanding, such as the Degrees of Reading Power Test, have been shown to fail to measure skills beyond the sentence level.

Measures of reading in the early grades that emphasize vocabulary and literal comprehension provide a suitable beginning, but they neglect language and word recognition skills that are needed in beginning reading. It has been shown by several researchers that first grade reading comprehension is predicted (correlations of .50 -.60) by skill in word recognition. Word recognition in turn is predicted by decoding, which refers to knowledge about how the oral language and written language are inter-related at the word level (correlations of .40 - .50) (Juel, Griffith and Gough 1986). Tests of reading at the beginning grades that are intended to serve as indicators of success and failure must reach below literal comprehension toward word recognition and decoding.

Measuring higher order reading skills is not accomplished by contemporary reading assessments. According to Frederiksen (1984), an Educational Testing Service psychologist, a severe constraint is located in the format of current tests. In reading tests, multiple choice formats are ubiquitous. Rarely has the brief passage with questions having four or five alternatives for responding, which was formulated in the 1920's, been replaced. Frederiksen asserts that multiple choice tests seldom require more than factual recall. For example, in the graduate record examination in psychology, 70 percent of the items are simple recall of content, a mere 12 percent require analytical thinking and only 3 percent of the items require evaluation. The requirement for inference, analyses, interpretation and application of principles are unusual.

This fixation on factual recall in multiple choice reading tests stands in stark contrast to the emphasis that high school teachers place on interpretation. George Hillocks (1984) convincingly

established a taxonomy of seven levels of interpretation in high school reading. These included comprehension of: 1) basic stated information; 2) key details; 3) stated relationship; 4) simple implied relationship; 5) complex implied relationship; 6) author's generalization; and 7) structural generalization. Students in Hillocks' study who could answer high level questions could answer all lower level questions, but not the reverse. One type of evidence that the multiple choice format neglects higher order processes is that tests with this format do not correlate highly with tests of other formats. This suggests that they measure different skills. The NAEP reading measure (with multiple choice format and literal questions) correlated only .58 with the prose scale of the adult literacy measure which used search, summary and short answer response modes (Kirsch and Jungeblut 1986). New response modes warrant fair try-outs and need to be developed to provide measures of higher-order outcomes.

Efforts in a few states are directed to developing assessments that are informed by the past two decades of research on reading processes. These assessments contain sections on comprehension of theme and gist in both narrative and exposition. They estimate the prior knowledge, or familiarity with the topics being assessed. Sections address the use of text structure and the awareness of cognitive strategies that have been emphasized in metacognitive research. Finally, they use substantial real-classroom samples of literature and science rather than decontextualized fragments of text created for testing. Although the jury is out for these measures, they illustrate some realistic possibilities in the reform of reading achievement measures (Pearson, Shanahan and Valenica 1986; Peters AND Wixson 1986).

In addition to incorporating higher order tasks, outcome indicators should be sensitive to the deficits of lower achievers. The National Assessment of Educational Progress (1981) report on reading and writing showed that inferential understanding rather than literal understanding is weak in high school students. The recent NAEP report on Young Adults (1986) states that the literary problem in the USA is not inability to read low level materials such as signs and labels in a

literal way, but deficiency in analytical skill required in complex prose or documents. For instance, only 11% of high school graduates used a bus schedule accurately in a realistically complex situation, and only 4% of this population could summarize a lengthy newspaper column. Furthermore, minorities such as blacks and hispanics trailed whites by large margins on these forms of reading achievement.

To prevent these problems, a diagnostic-instructional system for low achievers is needed, and indicators of its use are mandatory. For instance, the proportion of students who perform below scores such as 275 level on the NAEP prose and document scales could be identified and provided special treatment. Instruction should be started in eighth grade to allow time for earlier significant input; and the percent of students receiving the service who attain the 275 level should be monitored. The diagnostics should be focussed on language/cognitive deficits of minority students since this group is the majority of the target population. A critical feature of an indicator system is how well it spurs the advance of the low achieving group toward productivity in educational and occupational settings.

READING ACTIVITY

Engaging in reading activity for practical purposes has not been a universal criterion for judging whether students are being well taught. Most reading programs, however, aspire to teach children to be active, enthusiastic readers as well as high achievers. A majority of elementary schools reading systems aim to teach children who can read and who do read.

Whether students choose to engage in reading is not trivial. A large percentage of time children spend doing homework is consumed in reading textbooks, literature, or graphs and tables; and time spent doing homework is correlated with achievement in most subjects. Yet students do little homework in the USA. NAEP (1981) data show that 30 percent of 13-year-olds and 32 percent of 17 year olds report not doing any homework "yesterday." Beyond those groups who did absolutely nothing, 33 percent of 13 year olds and 24 percent of 17-year-olds spent less than one hour "yesterday" doing homework for school. If

students spend an average of 4.5 hours per day watching TV for entertainment, and only .85 hours per day reading-to-learn outside school, the prognosis for their knowledge and problem solving as adults is low. With over half of the student population in middle and high school devoting little or no time to reading-for-learning outside of the school building, it seems unlikely that this population will be able to meet the reading demands of the workplace and adult life.

According to the adult literacy report from NAEP (Kirsch and Jungeblut 1986) the amount of reading required in occupational settings is substantial. Documents such as tags, diagrams, tables, memos, reports and computer programs usually encountered at work are sometimes complex and young adults reported reading about 10 different types of such documents daily. Time budget analyses reveal that adults spend an average of 90 to 100 minutes per day reading at work to perform legitimate tasks (Guthrie, et.al. 1986). Furthermore, these documents often surpass textbooks in difficulty. Schools may not be preparing students for the volume and complexity of reading and information processing demanded today in adult life. This issue warrants a deeper analysis than this paper allows.

Reading for enjoyment declines precipitously throughout school. The question, "Do you enjoy reading?" was answered "very much" by 81 percent of 9-year-olds, 50 percent of 13-year-olds and 40 percent of 17-year-olds in a national NAEP survey. Time spent "yesterday" reading for enjoyment was zero for 28 percent of nine year olds, 42 percent of 13-year-olds and 44 percent of 17-year-olds and less than an hour for 25 to 35 percent of these students. Books fare the worst. When asked which they like the least 17-year-olds reported book reading in comparison to magazines or TV. Middle schools seem to be the point where children are turned-off to reading activity. From elementary to middle school there is a heavy decline in the frequency and the amount of reading activity, and a minor decrease follows in high school. Assessing the extent that students put their reading skills to use for school learning and recreation will shed light on this trend and aid in reversing it.

During the Colonial period it was safe to assume that the use of

reading was related to the proficiency level of individuals. Some administrators make the same assumption today. However, the relationship of reading achievement and reading activity is not simple. A weak positive correlation of .2 has been found for reading attainment and book reading among 10-year-olds (Greaney 1980). In the 1984 NAEP data for 13-year-olds, the frequency of magazine and newspaper reading was significantly correlated with achievement, but the strength of the association was low (Walberg and Tsai 1984). Therefore, achievement can not serve as a proxy for the occurrence of useful reading, or vice versa. The two factors are sufficiently independent to require their own measures and educational policies.

The inclusion of reading activity in a set of indicators is essential. Although measuring reading competence is vitally important, it is equally critical to know whether students apply this competence, and how long they persevere in a particular application. Such factors are rarely designed into reading assessments, but their promise is substantial.

III. PROCESS INDICATORS

CHARACTERISTICS OF PROCESS INDICATORS

Process indicators differ from outcome indicators in several respects. First, they measure a means for achieving desired results. They are utilitarian, and therefore their prime qualification is their effectiveness in measuring factors that produce defined and desired consequences. This instrumental character leads to a standard for selection, which is that process indicators must have a research base or an empirically verified theory driving them. Furthermore, process indicators, ideally, are causal factors that foster valued goals of schools rather than mere artifacts or proxies for the critical variables. To the extent they are proxies or unverified as causes, they can lead policymakers to erroneous conclusions about what the system "needs."

In addition, process indicators, should be expressed as metrics rather than as principles. A vague generality such as "teacher warmth fosters learning" is an inadequate ground for an indicator. Although the principle is not objectionable, the necessary amount of warmth is not denoted in this statement nor is its strength of relationship to reading achievement. A more useful formulation would be: one point of increase in teacher warmth (on a ten point scale) produces .3 points of reading achievement on test X (which is a five point scale), up to the seventh point on the warmth scale after which increases are not related to achievement. Without quantification at this level in the indicator, the existing status of the indicator, its changes, and the fulfillment of goals defined by it cannot be captured. Although these specifications are not widely available, they could be generated from secondary analysis of existing research literature.

An educational process indicator is most likely to be valid and fruitful if it is causally related to achievement. Statistics about factors that are remote from the site of learning (the student, the teacher, and the text) such as the size of the school library, are notably unrelated to learning and hold little promise as indicators.

In addition to being intrinsic to teaching-learning events, good indicators should be powerful after other factors that influence outcomes, such as student socioeconomic status, are controlled. Although an artifact such as the presence of bookbags in schools correlates with learning, giving out bookbags will not enhance achievement. Strong process indicators must affect outcomes after student background, school plant and equipment, and other "givens" of the environment are held constant.

Finally, an indicator should be robust. It should transcend a particular school, ethnic group or experimental investigation. Widespread replication of its relation with an outcome is assurance that it is worthy of adoption outside its original locus of use.

QUANTITY OF INSTRUCTION

A reasonable starting point in the construction of a process indicator system is the quantity of instruction. This variable points to the amount of teaching that occurs pertinent to reading achievement. Suppose an external evaluator were asked whether students are learning Czechoslovakian adequately in a certain school system. His first query would be about how much Czechoslovakian is taught to the students. Little learning occurs without teaching and large amounts of learning usually require large amounts of instruction. The obvious point in the Czechoslovakian case is under-recognized in English. Children are not born literate; and they do not grow more literate without continuous opportunities for guided learning.

Quantity of Courses

At the high school level, a first index of quantity is the number of courses taken. In a nationally representative data-base of 24,159 high school seniors, quantity of instruction was related to reading achievement significantly. For the population, the average number of courses in English, French, German, Spanish, history and science was 4.84, with a standard deviation of .92. While this is not reading instruction per se, it is academically oriented reading activity which is likely to improve reading achievement. After controlling for

economic status, sex, ethnicity, student motivation for academics and the amount of homework completed, the quantity of courses correlated .4 with reading achievement. Irrespective of six factors such as SES, increasing the number of courses with reading demands increased the reading achievement of the average school population, and this factor controlled 16 percent of the variance among students in achievement (Walberg and Shanahan 1983).

Quantity of School Teaching

The amount of reading instruction in school and its relation to achievement was analyzed by Walberg and Tsai (1985) for a national sample of 9-year-olds. Quantity was estimated by kindergarten attendance. The effect of quantity on NAEP reading achievement was controlled statistically for socio-economic level, sex and ethnicity. The quantity variable, nevertheless, had a standardized regression weight which was highly significant. This study shows that when home background and school-level variables were controlled, quantity of instruction was positively associated with achievement and attitude in reading.

Quantity of instruction is most likely to increase achievement when it enhances academic learning time. Berliner (1981) found that for 25 second-grade and 21 fifth-grade classes, academic learning time over six months had a substantial impact on standardized test results. Doubling student learning time from 23 to 52 minutes per day increased achievement test scores by about 40 percent. Percentiles were increased by 15 points, or one standard deviation. Merely extending the time in the schedule has little effect, according to Berliner, unless it extends the engagement of the learner in active reading. However, when time-on task for reading increases, reading achievement increases, for low achievers especially.

Instruction in elementary schools was reported by Goodlad (1984) to include little substantive reading or explicit teaching. With trained observers over a one-year period, he found that teachers estimated that 7.5 hours per week were spent in language arts instruction, which was 34 percent of all instructional time. For

comparison, science was given 2.3 hours per week and social studies was allocated 2.8 hours per week in these classes. Reading aloud occurred for 6 percent of the time of reading instruction in elementary schools, 3 percent in junior high and 2 percent in senior high. Listening to the teacher was 28 percent, 21 percent and 15 percent respectively. Performing workbook activities consumed 18 percent, 22 percent, and 25 percent of language-arts instruction or English instruction time. Actual reading or direct instruction in reading comprehension was remarkably low, a fact confirmed by Durkin (1978) in a classic paper. When engaged learning time is distinguished from allocated learning time (Berliner 1981) the quantity of opportunity to learn reading reduces to an average of 25-55 minutes per day in elementary classrooms. Doubling this number would be a worthy goal for a school or a state.

QUANTITY OF READING FOR HOMEWORK

Since it is reasonable to assume that reading consumes a substantial portion of homework time, quantity of homework time is a useful measure of the academic reading students perform out of school. Several confirmations of the value of homework for increasing achievement have been reported and this principle has also been quantified. Natriello and McDill (1986) report that for 10th, 11th and 12th grade students', in 20 high schools, more homework time increased the grade point average in English. Specifically, one hour of increase in homework per night produced an improvement of .13 in cumulative grade point average in English. Students who did two hours per night of homework had GPAs .13 higher than those who completed one hour per night. This relationship was controlled for parental aspirations for the student, academic track (including college, vocational and business), and standards, which is the amount of academic press expressed by the teacher, peers and parents of the students. Homework time is further influenced by teacher checks. In twelve English high schools, Rutter et al. (1979) found the average amount of homework in English language (reading and writing) was 1.1 hour per week and was correlated the achievement in English at .61. In addition, merely

checking homework by the teacher increased this association.

The amount of homework performed by US high school students has been reported by Walberg and Shanahan (1983) in a re-analysis of the high school and the beyond data, which include 24,000 students. An average of .85 hours of homework per day was reported in this US sample and the variable correlated with reading achievement at .24. This correlation was statistically controlled for socio-economic status, sex, attitude and motivation of the student and therefore has a reasonable verification as being causally related to achievement. This level of .85 hours per day compares unfavorably to the 4.4 hours per day of TV viewing by the same population.

Students do not doubt the returns for reading. A total of 98 percent of 13-year-olds say it is "very important" to be able to read. Further, they report enjoying it. A total of 96 percent enjoy reading "somewhat" or "very much." However, their behavior is not commensurate with these favorable affects. They either do no homework (37%) or less than one hour (33%) on a typical night. And although they receive newspapers (82%) and magazines (70%) regularly, they only read twice a week or less (65%) for enjoyment (Walberg and Tsai 1984). (Knowing these patterns, teachers hesitate to initiate the cycle of assigning, reviewing and checking homework.) Consequently, the quantity of learning opportunities students experience decreases exponentially. A reliable index of homework time represents a potential indicator that is calling for development.

QUALITY OF INSTRUCTION

Critics of the quantity of instruction contend that it is a limited concept, describing time devoid of substance. It is not time, they argue, but the events that occur in time that are instrumental for learning. These critics argue that time does not cause an iron pipe to rust, but chemical exchanges are the causal variables. Likewise reading instruction and reading activities are the causes of reading gains. Fortunately, the quality of these events has been studied sufficiently to permit indicators of their effectiveness to be developed.

Recent advances in the cognitive and social psychology of reading development have been extensive. They yield a set of principles that are conceptually coherent and empirically grounded. However, building policy-relevant indicators from these findings requires ingenuity.

Elementary school level reading research has been conducted from at least three perspectives. First, good readers, above the average for their grade, are contrasted with poor readers, and mental processes that differentiate them are charted. Second, age and developmental progression on key features of reading have been mapped. Third, studies containing mini-interventions (1-15 hours) that improve one cognitive process and then examine its effect on reading comprehension have shown quality-of-teaching effects at the micro-instructional level. The following characteristics of instructional quality have been abstracted from syntheses of research that integrate evidence from these three streams (Pearson and Gallagher 1983; Paris, Wixson and Lipson 1983). These characteristics are reading processes for which effective instruction has been documented. They are research-based features of exemplary teaching programs.

1. Using Students' Background Knowledge. With students from grade one through university level, it has been shown that what a person knows determines what is learned from reading. Reading is a transaction between the old knowledge of the learner and the new knowledge on the printed page. These transactions can, furthermore, be fostered by explicit teaching, which has been found to be particularly useful for minorities or culturally different learners. The extent that reading instruction relies on background knowledge should be measured and monitored.

2. Vocabulary. Teaching word meaning is traditional. In a review of research embracing 52 studies and 94 comparisons, Stahl and Fairbanks (1986) showed the power of vocabulary teaching. For grades two through five, instruction in word meaning enhanced performance on tests of vocabulary with an effect size of .97. That is, the groups taught vocabulary performed an average of one standard deviation higher than groups not taught vocabulary. Most important, vocabulary teaching enhanced comprehension in reading with an effect size of 1.30. This is

a substantial impact, even greater than the direct effect on vocabulary. Indicators of reading instruction should tap the extent and quality of vocabulary instruction.

3. Summarizing. Good readers keep a continuous, running summary of the main ideas they are reading. Stop a proficient reader in mid-passage and she can summarize the material read to that moment, at least moderately well. Students can be taught to summarize (Baker and Brown 1984), and this learning enhances the capacity to keep a continuous record of key ideas. Teaching students to summarize, then, enables self-directed learning to take place in the classroom (Wittrock 1978).

4. Inferencing. As learners digest what they read, they build a structure of information that includes inferences. For example, reading that "The boy crossed the river on his bike," a good learner presupposes that there was a bridge across the river. The bridge concept may be used later to understand another sentence. Poor readers do not spontaneously make such inferences, but may be taught to do so. Inference training not only improves inference making, but expands reading comprehension.

5. Metacognition. Efficient learners are aware of their current state of knowledge during learning. They discern a new idea when it arrives; they check whether they have integrated new information with what they know; they re-read as necessary. Poor readers, however, exhibit less awareness of what they know. Students may be taught, however, to "look back" during reading when they have not understood, to ask themselves questions, to clarify meanings that are vague. That is, they may be taught when and why to read reflectively (Paris et al, 1983; Baker and Brown 1984). Again, teaching these skills seem to benefit disadvantaged readers especially. Monitoring the teaching of these skills should be a part of keeping track of the health of a reading probram.

6. Sustained Reading. Excellence in reading education contains healthy amounts of purposeful reading activity in literature, science or other subjects. Students must engage in reading tasks that challenge and reward them. Active reading in high-interest,

high-information material may be started in class, sustained through homework, and used for acquiring knowledge in science, history or literature. Guided practice preceded by explicit teaching of cognitive processes, is a condition that will foster independent reading-for-learning.

V. RECOMMENDATIONS

To construct a system of indicators of reading education several elements must be assembled. These elements include measures of reading outcomes and reading instruction, both accounting for the characteristics of the student population they describe. Although few of these indicators are in widespread use for policy purposes, a majority of the units in the proposed indicator system have been used in research on learning and teaching.

1. Outcomes. An ideal model of indicators for reading education will contain outcome measures that suitably reflect developmental processes of reading acquisition and curriculum goals of teachers and policymakers. A full set of outcome indicators should include performance on the following sub-aspects of reading: 1) decoding, 2) literal comprehension, 3) locating information, and 4) higher order processes.

Existing tests of reading comprehension focus on literal comprehension and could be retained for that category. Measures of decoding are available from basic research, but are rarely used to evaluate learning despite the importance of decoding in early stages of growth. Likewise, a number of ingenious probes of higher order thinking-during-reading processes have been recently devised for research purposes (such as requiring students to detect inconsistencies that are based on both inference and explicit text statements). However, they have not been employed to evaluate learning or teaching on a broad scale. Finally, locating information in texts, encyclopedias or manuals is a separable skill that is frequently expected by teachers and demanded by employers, but is rarely evaluated. It has been tested partially under the guise of study skills. But this domain requires new tests that are grounded in research on metacognition and information processing.

Measures of achievement must be balanced by indicators of the active use of reading. Whether students choose to read affects their knowledge of the world, recreational satisfaction, and occupational

productivity as well as their grade point average in such subjects as English, science, and history. Indicators of reading activity have not previously been employed for purposes of policy, although national data, and data for at least one state, exist on this variable. Decision makers who have data on the amount of time and/or material read by students are in a position to evaluate the students' exposure to substantive content. These data signify whether the opportunity to learn through books is commensurate with the goals for achievement in such curricular areas as English, history and science, in which much of the sought-after knowledge is embodied in print.

2. Processes. The dual traits of instructional effectiveness--its quantity and quality--both should be contained in a full model of indicators. The quantity of instruction has been verified as a causal factor in reading achievement. It warrants adoption. The time allocated in the curricular schedule, however, is insufficient to measure this factor sensitively. Student learning time (i.e., time on appropriately difficult tasks) is the critical factor. Its estimation may be based on teacher self-report, student self-report or observation. Student learning time includes time in school, which is language arts or English instruction, combined with assigned reading or study instruction in content courses. Time out of school includes homework time (when it requires reading) and recreational reading. Each of these factors, in addition to number of courses taken in high school, has been shown to influence reading achievement, but they have not been developed into indexes of reading instructional quantity. Vital qualities of reading instruction have been identified in research. Conceptually, they are amenable to development as indicators which can serve as key statistics for policymakers.

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